

Remarks

Applicants now present a Preliminary Amendment that accompanies a Request for Continued Examination in the application identified above. Claims 2 and 3 are being cancelled. Claims 1, 7, 10, 12, 13, 16, and 17 have been amended to distinguish more clearly the claimed invention from reference Patent 6,116,363, taken alone or in combination with reference Patent 6,603,215. Claim 15 is being cancelled in favor of the other claims remaining in the case. Claim 14 was cancelled previously. The rejection of claims 2-6 under 35 U.S.C. § 112 no longer is applicable in view of the cancellation of claims 2 and 3 and the amendments to claims 4-6.

It is believed that the claims presently appearing in the application are distinguishable from reference Patent 6,116,363, taken alone or in combination with reference Patent 6,603,215. The '363 reference patent discloses a control method that includes the step of monitoring vehicle speed and depth of discharge of the battery and controlling the electric motor as a function of each of these variables. The powertrain can be operated in a zero emissions vehicle mode in which the battery alone acts as a source of driving torque, and in a hybrid electric vehicle mode in which the engine and the electric motor act together to provide driving torque. When the electric motor is operating as a source of driving torque, the internal combustion engine is uncoupled, or is turned off. The vehicle can be driven under most driving conditions using only the battery until the battery reaches a predetermined discharge state, such as 90% of depth of charge.

As indicated in Figure 3 of the '363 patent, the vehicle is launched using the electric motor. At step 150 in Figure 3 of the '363 patent, the vehicle speed, which is measured at step 110, is compared to a control curve. If the vehicle speed or battery depth of charge exceed a predetermined threshold, the engine is started and the disconnect clutch 24 is engaged. Thereafter, the engine is operable to supplement driving torque of the electric motor. The electric motor is turned off if the electric motor torque is not required. It usually is

required if there is a need for acceleration of the vehicle, or if the vehicle is climbing a hill, for example.

As long as the depth of charge is less than the so-called crossover point 260 shown in Figure 7 of the '363 patent and the vehicle speed is less than the maximum threshold value as shown at 270, the electric motor operating alone can provide the necessary driving torque. If the depth of discharge exceeds approximately 50%, as indicated in Figure 7, the internal combustion engine is brought online, but that occurs at varying speeds as indicated by the plot shown at 250 in Figure 7.

The control band between the "on" threshold plot 250 and the "off" threshold plot 280 shown in Figure 7 actually is a hysteresis band. This feature prevents undesirable cycling between the engine on state and the engine off state.

The control concept described in the '363 patent is entirely unrelated to Applicants' control concept. Applicants' claims, especially as they now are amended, clearly are distinguishable from the '363 patent control concept. Applicants' claimed invention uses not only a state of charge of the battery, but also a discharge power limit of the battery for determining whether the engine should be on or off. Applicants' arbitrator shown at 30 in Figure 1 receives state of charge data and discharge power limit data, as well as other powertrain parameters, and responds to requests by the state machine 28 to turn the engine on or off.

The parameters controlled by the invention defined in Applicants' claims are state of charge and discharge power limit. Applicants' claims do not depend upon vehicle speed. A plot such as that shown in Figure 7 of the '363 patent, which is really a function of battery depth of discharge and vehicle speed, is irrelevant to Applicants' claimed invention.

Furthermore, even if the state of charge and the discharge power limit of Applicants' powertrain were at a level that does not require a request for the engine to be

turned on, the engine is kept on if for some other reason the engine already has been turned on because of some other monitored variable such as temperature of the engine coolant.

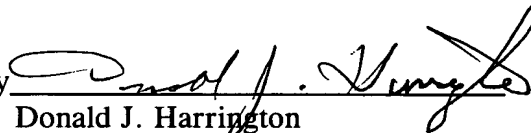
There is no counterpart in Applicants' claimed control method for the simple hysteresis concept illustrated in Figure 7 of the '363 patent. In Applicants' control method, a logic is employed to determine whether there is a need to keep the engine on if it has already been turned on by reason of a request by the state machine in response to other parameters, such as catalyst temperature, acceleration power, or engine coolant temperature. The response to a change in the values of state of charge and discharge power limit, as indicated in Applicants' claims, is completely independent of vehicle speed.

The region between lines 250 and 280 in Figure 7 of the '363 patent, as indicated previously, is merely a region that introduces a hysteresis effect. It is not equivalent to nor does it suggest an opportunistic region as in Applicants' control system. Applicants' opportunistic window is used to ensure that the engine, if the engine already is turned on, is not turned off when a transition is made from the engine off state to the engine on state. The converse of this is also true. That is, if the engine is off already, then the state machine will not turn the engine on when a transition is made from the on state to the off state when the operating point resides in the opportunistic window.

The secondary reference patent 6,603,215 neither discloses nor suggests features that can be combined with the '363 patent teachings to supply the deficiencies of the '363 patent described above. Paragraph 7 on page 4 of the Office Action contains a discussion of how state of charge value can be adjusted based on vehicle speed. As indicated in the above discussion, however, vehicle speed is not relevant to the strategy of the present invention in which discharge power limit (DPL) and state of charge (SOC), not vehicle speed, are monitored and used to determine whether the engine should be turned on or off.

It is believed that the claims as they now appear in the application are in allowable form. The issuance of a Notice of Allowance is solicited respectfully.

Respectfully submitted,
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